

1 Claims:

2 1. A coated powder having a coating on a powder substrate, the coating
3 comprising siloxy metal units.

4

5 2. A coated powder according to claim 1 comprising chains of multiple siloxy metal
6 units interconnected by oxygen atoms.

7

8 3. A coated powder according to claim 2 wherein the siloxy metal units have the
9 formula -Si-O-M- wherein M represents a metal having two or more valencies and
10 the additional silicon valencies and metal valencies, if any, are satisfied by
11 chemically inactive groups or atoms compatible with the coated powder and,
12 optionally the siloxy metal unit includes a first oxygen atom bonded to the silicon
13 atom and a second oxygen atom bonded to the metal atom.

14

15 4. A coated powder according to claim 4 having hydrophobic and lipophilic
16 properties or having hydrophobic and lipophobic properties.

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18 5. A coated powder according to claim 4 having hydrophobic and lipophilic
19 properties and being dispersible in silicone fluids.

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21 6. A coated powder according to claim 4 wherein the coating comprises a
22 continuous, complete, coherent coating extending over substantially the entire outer
23 surface of each powder particle, the coating being tenaciously covalently bonded to
24 the powder substrate.

25

26 7. A coated powder according to claim 6 wherein the coating includes chains of
27 polysiloxane units coupled to the substrate powder, and metallate units
28 interconnecting polysiloxane units.

29

1 8. A coated powder according to claim 1 wherein the coating includes the residues
2 of a multifunctional organometallate compound, and of a multifunctional silicon
3 compound.

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5 9. A coated powder according to claim 8 wherein the multifunctional
6 organometallate comprises a difunctional organotitanate compound and the
7 multifunctional silicon compound comprises a trialkoxysilane.

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9 10. A coated powder according to claim 4 being a cosmetic pigment or filler having
10 an average particle size of not more than about 100 micron.

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12 11. A coated powder according to claim 4 wherein the metal M is titanium,
13 aluminum, tin, vanadium, zinc or zirconium.

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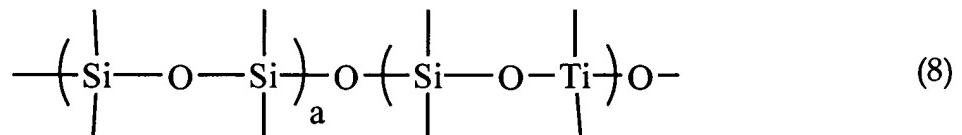
15 12. A coated powder according to claim 4 wherein the metal M is titanium, and the
16 coating comprises the residue of a chain of siloxy units, the siloxy units being
17 terminated with, or interspersed with, organometallate residues wherein the coating
18 includes crosslinking, terminal units bonded to the powder substrate and terminal
19 units capped with organometallate residues.

20

21 13. A coated powder having a coating on a powder substrate, the coating having
22 chains of units of the following structural formula (8):

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wherein a is from 1 to 1000, preferably from 1 to 100 and the unsatisfied valencies are occupied by other units of formula (8), said other units optionally being

1 crosslinking units, by powder substrate atoms or groups, or by residual unreactive
2 groups.

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4 14. A coated powder according to claim 13 wherein unsatisfied valencies not
5 satisfied by other units are satisfied by hydrocarbon groups, fluorohydrocarbon
6 groups, fatty acid ester groups or mixtures of the foregoing groups.

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8 15. A lipid- and silicone-dispersible coated cosmetic powder comprising cosmetic
9 powder particles and a hydrophobic coating on the cosmetic powder particles, the
10 hydrophobic coating conferring lipid and silicone dispersibility on the cosmetic
11 powder particles and comprising:

12 a) cosmetically stable hydrophobic organometallate units of formula $(R^6)_aM_1-O-$
13 wherein:

14 M₁ is a metal capable of forming cosmetically stable organometallate
15 compounds of the structure shown, including any of the metals M;
16 a equals the valence state of metal M₁ minus 1 or minus 2, wherein, in the
17 case of the latter alternative, the available valence of metal M₁ is covalently
18 bonded to another M₁ atom or to a coating material oxygen atom;
19 R⁶ is a hydrophobic organic moiety including a cosmetically stable covalent
20 bond to metal M or, when a is greater than 1, to an oxygen atom with an
21 available valence and wherein multiple R⁶s, if present, may be the same or
22 different; and

23 b) cosmetically stable siloxy units of formula D—R⁷—R⁸—Si—O-, wherein:
24 D is an oxygen atom with an available valence or a hydrophobic organic
25 moiety including a cosmetically stable covalent bond to the silicon atom; and
26 R⁷ and R⁸ may be the same or different and are each a hydrophobic organic
27 moiety including a cosmetically stable covalent bond to the silicon atom;
28 wherein the hydrophobic coating is covalently bonded to the cosmetic powder by
29 satisfaction of available oxygen valencies in the organometallate and siloxy units.

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2 16. A coated powder according to claim 15 wherein R⁷ and R⁸ include optionally
3 saturated hydrocarbon or fluorohydrocarbon groups having from 1 to 30 carbon
4 atoms and other such groups as will be apparent from the disclosure herein.

5

6 17. A coated powder according to claim 15 wherein the organometallate units
7 include units having two available oxygen valencies, at least one of the two
8 organometallate unit available oxygen valencies being satisfied by a covalent bond
9 to one of the siloxy units or to another organometallate unit, and wherein the
10 hydrophobic coating includes siloxy units bonded to the powder through
11 organometallate units.

12

13 18. A coated powder according to claim 15 wherein the siloxy units include units
14 having two available oxygen valencies at least one of the two siloxy unit available
15 oxygen valencies being satisfied by a covalent bond to one of the siloxy units or to
16 another organometallate unit and wherein the hydrophobic coating includes
17 polysiloxyl units.

18

19 19. A coated powder according to claim 15 wherein both the organometallate units
20 and the siloxy units include units having two available oxygen valencies and
21 wherein the hydrophobic coating includes polysiloxyl units bonded to the powder
22 through organometallate units.

23

24 20. A coated powder according to claim 15 comprising a stoichiometric proportion
25 of organometallate units to siloxy units of from about 0.05:1 to about 10:1.

26

27 21. A process of providing a hybrid coating on a cosmetic powder comprising
28 coating the powder with one coating agent comprising a functionalized silicon

1 compound and with another coating agent comprising an organometallate
2 compound under conditions producing a coated powder.

3

4 22. A process according to claim 21 wherein the powder is simultaneously mixed
5 with the functionalized silicon compound and the organometallate.

6

7 23. A process according to claim 21 wherein the functionalized silicon compound
8 and the organometallate are applied to the powder sequentially.

9

10 24. A process according to claim 21 comprising:

11 a) combining:

12 i) a powder to be coated;

13 ii) a liquid dispersion medium sufficient for a slurry;

14 iii) an organometallate compound of formula (1) herein; and

15 iv) a functionalized silicon compound;

16 to form a slurry;

17 b) thoroughly mixing the slurry;

18 c) filtering the slurry; and

19 d) heating the resultant paste to a temperature and for a time effective to yield a
20 dry powder.

21

22 25. A process according to claim 24 wherein the functionalized silicon compound
23 comprises a multifunctional silane, a multifunctional polysiloxane, a
24 multifunctional fluorinated or fluoroalkyl- silane or polysiloxane, or a mixture of
25 the foregoing functionalized silicon compounds.

26

27 26. A process according to claim 21 wherein each coating agents becomes
28 chemically covalently bonded, under the conditions of the coating process, to the

1 surfaces of the powder particles and contributes to the provision of a durable outer
2 layer or skin of a hybrid chemical nature enveloping each powder particle.

3

4 27. A process according to claim 26 wherein the coating comprises metal atoms,
5 silicon atoms and optionally, M-O-Si groups, as defined herein.

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7 28. A process according to claim 27 wherein at least one of the coating agents
8 comprises a bifunctional coupling agent capable of covalently bonding with the
9 substrate powder and with the other coating agent and wherein, optionally, the
10 bifunctional coupling agent has two or more functional entities.

11

12 29. A process according to claim 21 wherein the coating agents comprise a mixture
13 of organotitanate and trialkoxy alkylsilane coating agents and the coated powder is
14 hydrophobic and lipophilic or hydrophobic and lipophobic.

15

16 30. A process according to claim 21 wherein the organometallate compound
17 provides a hydrophobic residual unit in the powder coating and optionally
18 comprises a metallate compound having at least one enduring, unreactive,
19 hydrophobic organic group.

20

21 31. A process according to claim 30 , wherein the enduring organic group
22 comprises a saturated hydrocarbon optionally containing one or more phenyl
23 groups, the saturated hydrocarbon being attached to a metal atom by an oxygen
24 atom and wherein the organometallate comprises at least one displaceable groups
25 or atom attached to the metal atom by an oxygen atom to provide a functional
26 group.

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28 32. A process according to claim 21 wherein the organometallate compound is a
29 compound of formula (2) as defined herein.

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2 33. A process according to claim 21 wherein the functionalized silicone compound
3 comprises at least one functional entity capable of covalently bonding to a target
4 pigment surface, either directly or through an organometallate residue, under the
5 reaction conditions employed.

6

7 34. A process according to claim 33 wherein the functional entity comprises: a
8 lower alkoxy group covalently bonded directly to a silicon atom and having from
9 one to four carbon atoms; a halo atom; chloro and amino group; an imino group,
10 and/or a hydroxyl group; and ethylenically unsaturated group; an acrylic group; a
11 methacrylic group; a vinylic group; a halogenated group; a hydroxylated group; a
12 carboxyl or carboxylated group; a thiol or a mercaptan group; an epoxy group; an
13 ester group; a urethane group; a urea group; an amino acid group; or a polypeptide
14 group.

15

16 35. A process according to claim 21 wherein the functionalized silicon compound
17 has a structure providing a stable residue on the substrate powder and remaining
18 stable throughout subsequent processing, optionally cosmetic formulation.

19

20 36. A process according to claim 35 wherein the functionalized silicon compound
21 has a silicon backbone structure comprising a single silicon atom, a pair of silicon
22 atoms connected by a single covalent bond or a siloxy chain of formula $-(-\text{Si}-\text{O})-\text{r}$
23 wherein r is an integer of from 2 to 1,000 and wherein, optionally r is from 5 to 100.

24

25 37. A process according to claim 35 wherein the substituents in functionalized
26 silicon compound, other than the functional entity or groups, lack chemical
27 reactivity in the coating process and form stable entities in the powder coating, the
28 nonfunctional substituents optionally being selected from the group consisting of
29 saturated hydrocarbon groups, saturated fluorohydrocarbon groups, alkyl groups,

1 fluoroalkyl groups, each of the foregoing groups having from 1 to about 50
2 optionally from about 7 to about 25 carbon atoms per substituent.

3

4 38. A process according to claim 21 wherein the functionalized silicon compound
5 comprises a functionalized silicon compound according to formula (3), to formula
6 (4), to formula (5) or to formula (6), each formula being as defined herein.

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8 39. A process according to claim 21 wherein the functionalized silicon compound
9 comprises a functionalized fluorinated compound or fluorosilane compound
10 according to formula (7) as defined herein.

11

12 40. A process according to claim 21 comprising conducting the process under
13 conditions causing reaction of both the functionalized silicon compound and the
14 organometallate and causing reaction of one or both of the functionalized silicon
15 compound and the organometallate with the cosmetic powder.

16

17 41. A particulate pigment treated with a reactive titanium species and a reactive
18 silicon species under conditions causing reaction of both the titanium and the
19 silicon species and covalent bonding of the residue or residues of both the titanium
20 species and the silicon species to the pigment surface, providing a coated pigment
21 having hydrophobic properties and lipophilic or hydrophobic and lipophobic
22 properties.

23

24 42. A cosmetic powder coated by a process according to claim 21.

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26 43. A cosmetic product comprising a dispersion of one or more coated powders
27 according to claim 42.

28

29 44. A cosmetic product comprising a coated powder according to claim 1.

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2 45. A cosmetic product according to claim 44 comprising a liquid or powder
3 makeup, a lipstick, a nail enamel, an eye shadow or a mascara.

4

5 46. A cosmetic product comprising a coated powder according to claim 15.

6

7 47. A cosmetic product comprising a dispersion of an aqueous phase in an oil or in
8 a silicone phase or a dispersion of an oil or silicone phase in an aqueous phase
9 wherein each phase of the dispersion comprises cosmetic powder particles coated
10 to enhance dispersibility in the disperse medium, a common coating material being
11 used to coat the cosmetic powder particles in both phases of the dispersion.

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